UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/843,212	04/24/2001	Eric I-Chao Chang	MS1-666US	8802

22801 7590 03/25/2004

LEE & HAYES PLLC
421 W RIVERSIDE AVENUE SUITE 500
SPOKANE, WA 99201

EXAMINER	
BRANT, DMITRY	

ART UNIT	PAPER NUMBER
2655	4

DATE MAILED: 03/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/843,212	CHANG ET AL.	
	Examiner	Art Unit	
	Dmitry Brant	2655	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 April 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 2.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-5, 10-14, 19-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Yeldener (5,890,108).

The U.S. patent of Yeldener teaches a computer-based system. Therefore, the methods and computer code necessary to implement this systems are inevitably part of Yeldener's teachings.

Claim #	Limitations	Yeldener
1, 10, 19	A method comprising: Identifying an initial set of pitch value candidates within each frame of a plurality of frames of received audio content utilizing a first pitch estimation algorithm and reducing the initial set of pitch value candidates to a select set of pitch value candidates based, at least in part, on pitch value re-scoring utilizing a second pitch estimation algorithm, wherein the select set of pitch values are selected in substantially real-time.	Two-step process (**Col. 10, lines 14**): "In the first step, the spectrum of the input signal ... is used to compute a rough estimate of the pitch F0 In the second step of the process the pitch estimate is refined using a spectrum of the signal sampled at a higher regular sampling frequency fs."
2, 11, 20	The method according to claim 1, further comprising: calculating a transition probability between at least one of the select pitch value candidates of adjacent	Backward/forward pitch tracking by calculating correlation functions for a given pitch candidate with previous and future frames (**Col. 11, lines 61-**

	frames.	and future frames (**Col. 11, lines 61-65 and Col. 12, lines 14-25**). Inherently, the higher/lower correlation between pitch candidates between frames indicates the higher/lower probabilities that the pitch does not change between frames.
3,12,21	The method according to claim 2, further comprising: selecting a pitch value within each frame with the highest transition probability between adjacent frames as the pitch value for the frame.	The maximum backward cross-correlation is compared to maximum forward average cross-correlation and the large values is used to determine optimal pitch Po. (**Col. 12, lines 28-32**). Therefore, the optimal pitch will have the highest correlation with the pitches of adjacent frames and hence the highest probability of transitioning unchanged between these frames.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The U.S. patents of Yeldener, McCree and Cook et al. teach computer-based systems. Therefore, the methods and computer code necessary to implement these systems are inevitably part of their teachings.

5. Claims 4, 13, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeldener in view of Tucker et al. (6,675,144).

Yeldener teaches using distance measures (best paths) for to calculate optimal spectral peaks that are used in forward/backward correlation functions. (**Col. 10, lines 57-65**)

Yeldener does not disclose calculating best paths using dynamic programming.

Tucker et al. teaches the use of dynamic programming to calculate best paths. (Col. 11, lines 5-8)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Yeldener as taught by Tucker in order to calculate distance measures using dynamic programming, because dynamic programming is a well-known and computationally efficient manner of computing best paths.

6. Claims 5-6, 14-15, 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeldener in view of McCree (6,463,406).

Yeldener discloses smoothing the pitch over previous pitch values and the value of the future frame (Col. 13, lines 45- 48) (smoothing a curve representing the select pitch values over a plurality of frames)

Yeldener does not disclose pitch smoothing, based on "other information", such as "one or more of an energy value for each frame, a zero crossing rate of the audio content, and/or vocal tract spectrum of the audio content."

McCree teaches smoothing over frequency bands that are chosen from within the vocal track spectrum (Col. 8, lines 58-61 and Col. 7, lines 48-51)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Yeldener as taught by McCree in order to improve the pitch smoothing process, because smoothing only over the ranges where human speech can occur would de-emphasize the noise coming from other ranges, thus reducing the possibility that non-speech signals would interfere with the pitch tracking process of human speech signals.

7. Claims 7-8, 16-17, 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeldener in view of Cook et al. (5,353,372).

As per claims 7,16,25, Yeldener discloses the use of AMDF for first step of pitch detection (Col. 13, line 64)

Yeldener does not disclose "selecting N near-zero minima pitch values in the audio content as the initial set of pitch value candidates."

Cook et al. teach (as background information) that AMDF pitch detection necessarily involves estimating period using the location of the minimal pitch values, as near-nulls occur at or around integer multiples of the period. (Col. 2, lines 35-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Yeldener as taught by Cook et al., in order to provide a rough estimate of the pitch, because it is well-known among practitioners that performing AMDF detection would necessarily involve selecting a set of near-zero pitch values from the output of AMDF.

As per claims 8, 17, 26, neither Yeldener nor Cook et al. teach setting N to 288.

It would have been obvious to one of ordinary skill in the art at the time the invention was made that AMDF detector would require a sufficient number of zero samples in order to produce a reasonable approximation of pitch. This happens because tested signal is often not truly periodic and pitch nulls exist between integer values of the period. As a result, selecting a larger set of test values, such as 288, would improve the reliability of pitch estimation.

8. Claims 9, 18, 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yeldener.

Yeldener discloses the use of normalized cross-correlation function (NCCF) for forward and backward pitch tracking computations (Col.11, lines 6-21)

Yeldener does not disclose using NCCF for the second step of the pitch estimation process, where the originally selected set of pitch values is further reduced with NCCF to a "select set of pitch values."

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made that NCCF is a commonly used method of computing correlation within a group of signals. Therefore, one could further limit the first set of pitch estimates by first computing NCCF for each signal in the set and then choosing the signals that have the highest NCC values, because these signals are more likely to estimate the correct value of pitch than signals that do not correlate with the group.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Yeldener to use NCCF on the first set of estimated pitch values and pick M best cross-correlated values as possible pitch estimates, because using highly cross-correlated estimates will further improve the probability that the picked estimates correspond to the actual pitch value.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Chazan et al. (6,587,816) teach fast frequency domain estimation of pitch.
Zinser, Jr. et al. (6,138,092) teach using AMDF for pitch tracking.
Acero et al. (6,226,606) teach a two-step pitch tracking system and method
McCree (6,470,309) teach sub-frame based correlation.

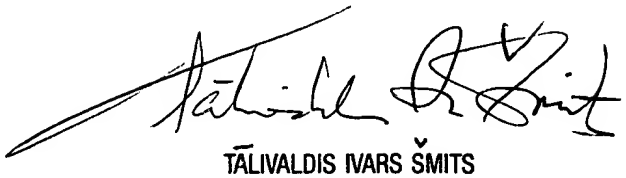
9. Any inquiry concerning this communication or earlier communications from the Dexaminer should be directed to Dmitry Brant whose telephone number is (703) 305-8954. The examiner can normally be reached on Mon. - Fri. (8:30am - 5pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Talivaldis Ivars Smits can be reached on (703) 306-3011. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to Tech Center 2600 receptionist whose telephone number is (703) 305- 4700.

DB

3/15/04



TĀLIVALDIS IVARS ŠMITS
PRIMARY EXAMINER